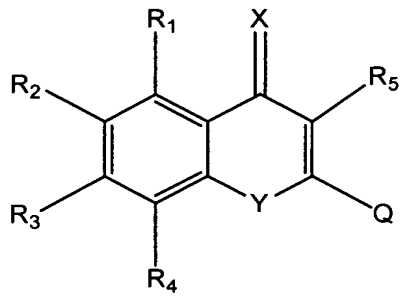
What is claimed is:

1. A compound of formula I



(I)

wherein:

R_1-R_4 are independently H, alkyl, alkenyl, alkynyl, OH, NH_2, SH, O-R_6, N-R_7R_8, or a halogen;

R_5 is H, SH, OH, O-R_6, or N-R_7R_8;

R_6 is H or C_1-C_4 alkyl;

R_7 and R_8 are independently H, C_1-C_4 alkyl, O, or S;

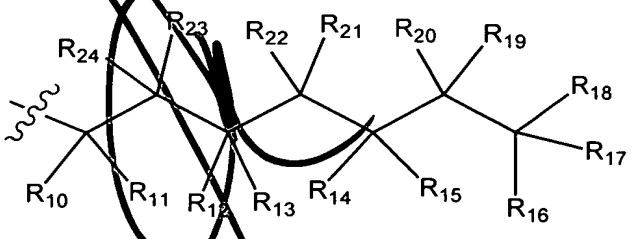
X and Y are independently S, O, or N-R_9;

R_9 is H, O, S, or C_1-C_4 alkyl;

Q is a tail group; and

salts thereof.

2. The compound of claim 1, wherein Q has formula IA



(IA)

wherein:

R_{10}-R_{13} are independently H, C_1-C_4 alkyl, OH, NH_2, SH, O-R_{25}, N-$R_{26}R_{27}$, or a halogen, or R_{10} and R_{11} taken together form a carbonyl, a sulfonyl or an imino moiety, or R_{12} and R_{13} taken together form a carbonyl, a sulfonyl or an imino moiety;

R_{14}-R_{24} are independently H, C_1-C_4 alkyl, OH, NH_2, SH, O-R_{25}, N-$R_{26}R_{27}$, or a halogen;

R_{25} is H or C_1-C_4 alkyl; and

R_{26} and R_{27} are independently H, C_1-C_4 alkyl, O, or S.

3. The compound of claim 2 that is different than 2-heptyl-3-hydroxy-4-quinolone .

4. The compound of claim 2, wherein R_{16}, R_{17}, and R_{18} are H.

5. The compound of claim 2, wherein R_2 is halogen.

6. The compound of claim 2, wherein R_3 is halogen.

7. The compound of claim 2, wherein R_4 is halogen.

8. The compound of claim 2, wherein X is S or N-R_9.

9. The compound of claim 2, wherein Y is O, S, or N-R_9 and wherein R_9 is C_1-C_4 -alkyl.

10. The compound of claim 2, wherein R_5 is H, SH, O-R_6, or N-R_7R_8, and wherein R_6 is C_1-C_4 alkyl.

11. The compound of claim 2, wherein R_5 is SH, O-R_6, or N-R_7R_8.

12. The compound of claim 2, wherein X is O.

13. The compound of claim 12, wherein R_5 is OH and Y is N-R_9.

14. The compound of claim 1, wherein Q is an alkylene chain having a skeleton of three to twenty carbon atoms.

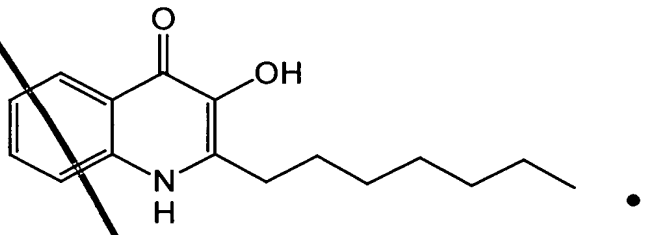
15. The compound of claim 14, wherein the alkylene chain contains one or more double bonds or triple bonds between the carbon atoms forming the skeleton alkylene side chain.

16. The compound of claim 14, wherein one or more carbon atoms forming the skeleton of the alkylene side chain are replaced with sulfur or sulfur-substituted moieties.

17. The compound of claim 2, wherein the compound contains a chiral center.

18. The compound of claim 2, which is an optically active isomer.

19. The compound of claim 1, comprising the formula:

(II) 

20. An autoinducer molecule comprising a compound of any one of claims 1, 2 or 19.

21. The autoinducer molecule of claim 20 that regulates gene expression.

22. The autoinducer molecule of claim 21 that regulates gene expression in bacteria.

23. The autoinducer molecule of claim 22, wherein said bacteria is *Pseudomonas aeruginosa*.

24. The autoinducer molecule of claim 23, wherein said gene expresses a virulence factor.

25. The autoinducer molecule of claim 24, wherein the virulence factor is elastase.

26. The autoinducer of claim 20 that regulates the activity of the LasR protein of *Pseudomonas aeruginosa*.

27. The autoinducer of claim 20 that regulates the activity of the RhlR protein of *Pseudomonas aeruginosa*.

28. The autoinducer molecule of claim 20 that is isolated from culture media in which *Pseudomonas aeruginosa* is grown.

29. A compound of claims 1 or 2 that modulates the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone .

30. The compound of claim 29 that inhibits the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone.

31. The compound of claim 29 that synergistically enhances the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone.

32. A compound of claims 1 or 2 that modulates the activity of the LasR and/or the RhlR proteins of *Pseudomonas aeruginosa*.

33. The compound of claim 32 that is an antagonist of the LasR and/or the RhlR proteins of *Pseudomonas aeruginosa*.

34. The compound of claim 32 that is an antagonist of the LasR and/or the RhlR proteins of *Pseudomonas aeruginosa*.

35. A pharmaceutical composition comprising a therapeutically effective amount of a compound of claim 1 and a pharmaceutically acceptable carrier therefor, wherein the compound inhibits the activity of one or more proteins in a microorganism that regulate expression of virulence factors.

36. The pharmaceutical composition of claim 35, wherein the compound is present in an amount effective to affect the ability of the microorganism to initially infect or further infect an organism.

37. The pharmaceutical composition of claim 35, wherein the microorganism is *Pseudomonas aeruginosa*.

38. The pharmaceutical composition of claim 37, wherein the compound inhibits the activity of the LasR and/or the RhlR proteins of *Pseudomonas aeruginosa*.

39. The pharmaceutical composition of claim 38, wherein the compound inhibits the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone .

40. The pharmaceutical composition of claim 35, further comprising an antimicrobial, antibacterial or antifungal agent.

41. A method of inhibiting the infectivity of *Pseudomonas aeruginosa* comprising administering to a subject a therapeutically effective amount of a compound of claim 1,

wherein the compound inhibits the activity of the LasR and/or the RhlR proteins of *Pseudomonas aeruginosa*.

42. The method of claim 41, wherein the compound inhibits the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone .

43. A method of treating an immunocompromised subject infected with *Pseudomonas aeruginosa* comprising administering to a subject a therapeutically effective amount of a compound of claim 1, wherein the compound inhibits the activity of the LasR and/or the RhlR proteins of *Pseudomonas aeruginosa*.

44. The method of claim 43, wherein the compound inhibits the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone .

45. The method of claim 43, wherein the subject is afflicted with cystic fibrosis.

46. A culture medium for microorganisms comprising, as an added compound, an autoinducer molecule as defined in claim 20, at a concentration effective to stimulate or promote the metabolism, growth and/or recovery of the microorganism.

47. The culture medium of claim 46, wherein the microorganism is *Pseudomonas aeruginosa*.

48. The culture medium of claim 47, wherein the autoinducer is 2-heptyl-3-hydroxy-4-quinolone.

49. A method for identifying a compound that modulates an autoinducer molecule in bacteria, said method comprising:

providing a cell which comprises a quorum sensing controlled gene, wherein said cell is responsive to an autoinducer molecule of claim 20 such that a detectable signal is generated;

contacting said cell with an autoinducer as defined in claim 20 in the presence and absence of a test compound; and

detecting a change in the detectable signal to thereby identify said test compound as a modulator of an autoinducer molecule in bacteria.

50. The method of claim 49, wherein the compound inhibits the autoinducer molecule.

51. The method of claim 49, wherein the compound synergizes activity of the autoinducer molecule.

52. The method of claim 49, wherein said bacteria is *Pseudomonas aeruginosa.*

53. The method of claim 49, wherein the autoinducer is 2-heptyl-3-hydroxy-4-quinolone.

54. The method of claim 52, wherein the compound inhibits binding of the autoinducer molecule to LasR and/or RhlR.

55. A method of regulating the expression of a gene in bacteria comprising:

inserting a gene into bacteria chosen for enhancement of gene expression by a compound of claim 1 that enhances the activity of the LasR and/or RhlR protein; and

incubating the bacteria with a compound of claim 1 that enhances the activity of the LasR protein, such that the expression of the gene is regulated.

56. The method of claim 55 wherein the method further comprises the additional steps of:

allowing the gene expression to reach a desired level; and

incubating the bacteria with a compound of claim 1 that inhibits the activity of the LasR and/or RhlR protein, thereby regulating the gene expression by the bacteria.

57. An inhibitor of the autoinducer activity of 2-heptyl-3-hydroxy-4-quinolone.

58. An analog of 2-heptyl-3-hydroxy-4-quinolone that inhibits the induction of virulence factors by 2-heptyl-3-hydroxy-4-quinolone, LasR or RhlR.

59. The analog of claim 58, wherein the virulence factor is exotoxin A.

60. The analog of claim 58, wherein the virulence factor is elastase.

61. The analog of claim 58, wherein the virulence factor is an alkaline protease.

62. An analog of 2-heptyl-3-hydroxy-4-quinolone that inhibits the induction of biofilm formation by 2-heptyl-3-hydroxy-4-quinolone, LasR or RhlR.

63. A method for modulating quorum sensing signaling in bacteria, said method comprising:

providing bacteria that comprise a quorum sensing controlled gene, wherein said bacteria are responsive to an autoinducer molecule; and

incubating the bacteria with a compound of claim 3, such that quorum sensing signalling in bacteria is modulated.

64. The method of claim 63, wherein the autoinducer molecule is 2-heptyl-3-hydroxy-4-quinolone.